Wind & Hydropower Technologies Program

Renewable Energy from Abundant Domestic Resources

Overcoming Technology and Market Barriers

Much of the immense energy potential of our nation's wind and hydropower resources remains untapped. Through strategic research and development (R&D), the Wind and Hydropower Technologies Program enables greater use of these domestic resources for electric power generation, helping to stabilize energy costs, enhance energy security, and improve our environment.

The Program conducts competitively selected, cost-shared R&D projects in collaboration with industry, and through partnership activities with Federal, state, industry, and other stakeholder groups. Most wind research is carried out at world-class facilities located at the Department of Energy's National Renewable Energy Laboratory, in cooperation with Sandia National Laboratory, while hydropower research is conducted at Idaho National Energy and Environmental Laboratory, Oak Ridge National Laboratory, and Pacific Northwest National Laboratory.

Bringing Wind Power to More Markets

Over 4,600 megawatts of wind generating capacity is operating in the United States today, providing enough electricity on average to meet the needs of over one million homes. The domestic market is growing rapidly, with over 1,700 megawatts installed since 2001. In our nation's strongest wind resource areas, wind power prices have become competitive with more established technologies, particularly when combined with enhanced regulatory and tax policies.

Now the challenge is to competitively harness wind energy in areas with more moderate wind resources—areas that are over twenty times more abundant than those currently being developed, and on average five times closer to large markets for power. By focusing on cost-effective technologies for lower wind resource areas, the Program will reduce the need for costly new transmission lines. The Program also conducts R&D on smaller wind energy systems capable of serving a broad range of distributed energy needs.

Competitive Electric Power

- *About 7 to 9 percent of U.S. electricity comes from hydropower. About half of U.S. hydropower capacity is government-owned and operated.*
- *Wind energy is one of the world's fastest-growing technologies, with market growth of 30 to 40 percent annually.*
- *Commercial wind energy systems are currently installed in 26 states. One typical wind turbine today can, on average, supply the electricity needs of 300 to 500 homes.*
- *The cost of producing electricity from wind has decreased from 80 cents per kilowatt-hour in 1980 (in current dollars) to 4 to 6 cents today.*

Improving Hydropower Plants

With 80,000 megawatts of generating capacity, hydropower is the nation's largest renewable source of electricity. Hydropower plants also provide water supply, flood control, navigation, and recreation. Working with industry, the Program pursues R&D on advanced hydropower turbines that reduce injuries to fish, and on technologies that boost oxygen levels in hydropower water flow, to minimize downstream impacts on aquatic life. Researchers from the Idaho National Energy and Environmental Laboratory, Oak Ridge National Laboratory, and Pacific Northwest National Laboratory are supporting these efforts and conducting field and computational studies to improve plant design and operation.

The Wind and Hydropower Technologies Program is also developing strategies for integrating wind and hydropower technologies, taking advantage of the benefits of each to optimize electric power system operation. Through integrated strategies, hydropower can buffer fluctuations in wind power, increasing the economic value of the power delivered. Likewise, wind energy can provide hydropower operators with additional flexibility in managing their water resources.

R&D Partnerships Yield Results

Through a series of cost-shared R&D partnerships, the Program has played a major role in dramatically reducing the cost of energy generated by utility-scale wind turbines from over 6 cents per kilowatt-hour in 1994 to 3.3 cents today. R&D efforts included leading-edge design assistance, unique and critical testing of large components, and close technical support for monitoring and improving the first prototypes in the field. Further partnerships with utilities helped verify and refine the real-world operating performance and reliability of the new machines.

In April 2002, General Electric acquired wind energy system design, manufacturing, and operations assets, including technologies developed through these partnerships, becoming one of the world's leading suppliers of wind turbines. Thanks to R&D partnerships, the Program helped U.S.-based industry capture about one third of a 2.5 billion-dollar domestic wind energy market since 1998, a share that otherwise would have been met through import of highly competitive overseas products.

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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